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220 SEVENTH STREET, NE  
CHARLOTTESVILLE, VIRGINIA 22901-5396

FSTC-HT-0182-90



AD-B148 940

DATE: July 19, 1990

ENGLISH TITLE: The MI-24: The realization of a concept.

TRANSLATION OF: *Kryl'ya rodiny*. 1989. No. 5, 24-26.

LANGUAGE: Russian.

COUNTRY: Union of Soviet Socialist Republics.

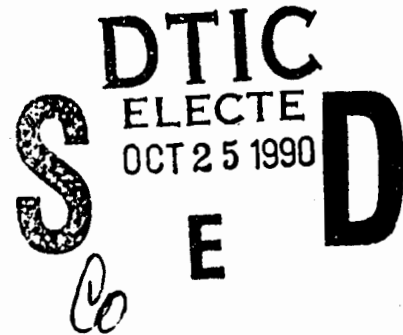
COUNTRY OF ORIGIN: Union of Soviet Socialist Republics.

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REQUESTER: AIFRBC (Catlett).

TRANSLATOR: Language Learning Enterprises.

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Mi-24--Implementation of the Concept  
(Mi-24--Osushchestvleniye kontseptsii)

by

Aleksey Radin, Engineer  
From Kryl'ya rodiny, May 1989, pp. 24-26

In the early 1960's, Mikhail Leont'evich Mil', the designer and scientist, under whose leadership were developed the Mi-1, Mi-4, Mi-6, Mi-2 piston and gas turbine helicopters and other helicopters, proposed developing a special assault helicopter [helicopter gunship] for the armed forces. Many military commanders and aviation specialists greeted his proposal with bewilderment, to say the least, and some were extremely critical.

A discussion broke out. According to some of its participants, veteran helicopter builders, it was an acrimonious debate. After all the subject was an extremely complex and costly long-range program, whose end result was far from clear to everyone.

M. L. Mil's opponents in principle were for the development of a new kind of helicopter for the army. The military conflict in Korea in the 1950's and a number of military exercises showed the effectiveness of such aircraft in military operations, for transportation and communications, for medical evacuation, for reconnaissance and for adjusting artillery fire. The opponents of the new program said that the helicopter had proved itself for these and similar purposes, but that it would be utopian to develop a helicopter for use on the battlefield, where tanks lorded it on the ground and supersonic aircraft with powerful weapons reigned over it. It was manifestly clear that the probability of the helicopter's brief survival in the air in modern battle was virtually nil.

His opponents based their negative reaction to the development and the decision for a specialized helicopter for the armed forces on what were, at first glance, quite persuasive comparisons and examples.

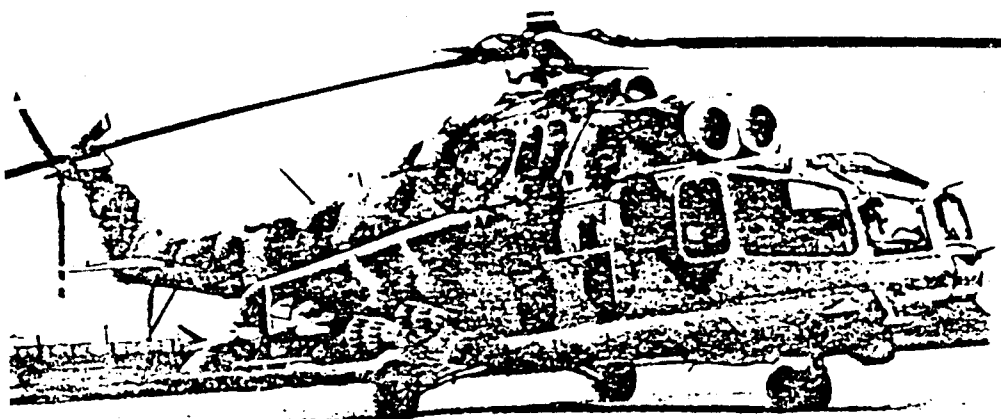
Now, in the 1960's, does it make any sense to propose that the armed forces use an aircraft on the battlefield that has a speed only slightly higher than one tenth the speed of modern planes which it will encounter in its missions, or with armor twenty to twenty-five times thinner, or with a caliber of weapon one tenth that of the tanks which the helicopter is designed to attack? Do the designers seriously suggest that the helicopter's crew will have any kind of chance executing its combat mission and striking the target in contact with such enemies?



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Even success in assaulting infantry subunits is doubtful. After all, in addition to having conventional tube weapons, say, such as large-caliber machineguns so dangerous for low-flying helicopters, they also have portable antiaircraft systems. Equipped with infrared homing warhead missiles, they are capable of destroying even high-speed helicopters, and our vehicle could only develop a maximum of 300 km/h. It is no accident, the opponents emphasized in conclusion that they are not building such helicopters abroad. They simply do not see any sense in it.

Such opinions reflected the level of military knowledge and views in the early 1960's on the helicopter's capability. However, time showed that M. L. Mil' and his supporters were looking farther, and were correctly evaluating the prospects for the helicopter, probable forms and methods of using it in battle corresponding to the tactical and technical features their proposed vehicle would possess. Convinced of the correctness of their concept, they began to carry it out in practice.



First series Mi-24.



One of the models of subsequent series.

## TIME AND EXPERIENCE CONFIRM

To verify just how much foresight, in terms of both the technical as well as military and tactical respects, was in the concept of the Soviet advocates of a specialized helicopter "for the battlefield" in the 1960's, it is sufficient to glance at foreign aviation journals from the middle of the next decade. In them are materials of military and aviation experts and journalists that testify to the fact that an assault helicopter to an increasingly greater degree has become one of the principal kinds of defensive weapons of modern army large formations.

A great many pages are taken up with theoretic articles, descriptions and photographs of NATO assault helicopters-- the "Cobra" and "Apache" and others, with examples of their use in the course of various exercises and "small" military conflicts. The authors note the high degree of effectiveness of specialized assault helicopters, and they emphasize their higher rate of survivability in comparison with other kinds of vehicles and their special capability of attacking targets suddenly and avoiding counterstrikes. To accomplish this their crews use an especially low altitude (between 0 and 15 m) in approaching the target; radar "sees" a target close to the ground poorly, and missiles with infrared homing warheads lose their effectiveness.

The unique capability of a helicopter to change the speed from maximum to zero, to fly on its side, with its tail forward, to maneuver abruptly near the ground itself, to use terrain relief for cover reduces its vulnerability. It was no accident that a prominent French general once characterized the assault helicopter as the "king of the sky near the ground."

They especially often write abroad about the role of assault helicopters in operations against mobile tank formations. In the summer of 1980, the American journal Army Aviation Digest in particular described such an operation, which the press terms typical for the armies of NATO. These publications revealed the actual strike and defensive capabilities of the assault helicopter in general and in particular its chances of surviving over a modern battlefield, and what M. L. Mil's supporters were saying almost two decades ago and what his detractors and those opposed to the development of such a helicopter were saying.

The actions of a helicopter unit in a "typical operation", judging by their accounts in western journals, in exercises proceed in the following fashion:

...After receiving the order to halt the movement of enemy tanks heading toward a key center of defense, a helicopter group flies to the departure positions in the area of probable enemy movement. The commander's helicopter conducts reconnaissance. Using the features of the terrain, the helicopter flies at an altitude above the treetops. This does not allow enemy planes to detect the reconnaissance helicopter, and if there is detection it minimizes the opportunity of an effective attack, since in the "air near the ground" guided missiles are marginally effective. In an attack using cannons or free-flying missile warheads, the interceptor's pilot must aim at a target capable of sharply changing altitude and speed, down to zero even, deviating on any heading and evading behind ground cover. Any of these maneuvers by the plane at minimal altitude carries the threat of crashing into the ground. The helicopter's crew, evading the strike, can send into pursuit the plane pulling out from the attack with a guided missile and destroy it. (The press reported a case of such an unfavorable air battle outcome for a plane.)

Using the technical capabilities of its helicopter, the crew while hovering observes the approaching tanks, concealed for example behind the crowns of trees, or behind a hill or simply behind a building. When additional observation of the tanks is necessary, the reconnaissance helicopter changes position stealthily. After evaluating the situation, the commander orders his group to fly into the region that will permit an assault on the enemy from various axes within the effective range of fire of helicopter antitank guided missiles (PTUR). Just as the tanks and their accompanying antiaircraft weapons begin to enter this area, the helicopters execute a vertical takeoff over the cover (so called "gallop up") and train bursts of guided missiles on targets that were assigned among the crews in advance.

Since the effective range of several types of PTUR exceeds the effective range of antiaircraft tube artillery, the helicopter crews, taking their machines right down to the ground, strike targets while staying outside the danger zone of air defense. Strike probability of helicopter PTUR is very high--up to 90%. After firing the missile, the helicopters immediately head for cover and fly to another position chosen in advance for a repeat strike.

In situations of an unexpected encounter of the helicopters passing by a building with mobile antiaircraft mounts or with infantry subunits with portable antiaircraft missile systems, the crews activate the on-board free-swinging machinegun mount and deception equipment for IF warheads of homing missiles, and they quickly exit the danger zone. The crew is protected from the machineguns of the infantry by the armored cabin and bullet-proof glass.

Military experts, analyzing the results of a series of

maneuvers and exercises conducted by NATO troops stress that the loss ratio in helicopter against tank operations fluctuates, as reported in particular by International Defense Review, between 1:12 up to 1:19 in favor of helicopters.

In sum in the late 1970's facing the facts, M. L. Mil's opponents acknowledged the effectiveness of assault helicopters and in particular their high level of survivability in executing primary missions on the field of battle. Design ideas began to be turned into concrete solutions component by component.

### Natural Development of the Concept

A team of the experimental design bureau headed by M. L. Mil' was one of the first to conduct tests using a helicopter as a platform for guided missile weapons. (PTUR firing had already been conducted from an Mi-1 helicopter). It was the first to introduce in helicopter construction the built-in, swinging machinegun mount as an organic weapon (on the Mi-4 helicopter). For this reason the appearance in the sky in the late 1960's of the Soviet Mi-24 specialized assault helicopter is the natural stage of development of a progressive concept. What kind of a helicopter is this?

The prototype Mi-24 (see sketch) is a classic, single-rotor design helicopter with twin turbine engines. Based on conducted research, the experimental design bureau team and its leader considered this design to be the best for an assault helicopter, also from the point of view of combat survivability. Should one of its engines be damaged, the crew can in theory continue to execute the combat operation. Flight is ensured by the second engine automatically operating at maximum capacity. Should both engines go out of service, the helicopter can execute a landing on even a small pad because of the exceptional autorotational features of the main rotor [carrying system] and the excellent heading controllability during autorotation that is ensured by the continuous operation of the steering rotor. In case the steering rotor is lost, it is possible to continue flying at starting speed and to execute a landing airplane-style.

The booster elements of the control system for the main rotor also make the single-rotor design preferable in terms of combat survivability, even when compared to more powerful twin-rotor helicopters of the same flying weight. Some expansion of the lateral surface area of the helicopter with a tail boom M. L. Mil' considered insignificant. It would be unlikely that anyone would train aimed fire directly at the, compared to the fuselage, narrow boom and the transmission parts running through it to the tail rotor.

Afterwards assault helicopter designers in the West were

apparently guided by similar considerations. Every existing helicopter of this type, for example, the "Huey Cobra," "Apache," and "Mongoose" and newly designed ones are built or are being developed according to this design.

In contrast to his preceding helicopters, in the Mi-24 M. L. Mil' situated the two-man crew in a new way--one on top of the other. This lowered frontal aerodynamic resistance of the helicopter, while at the same time reducing the probability of losing two pilots to a strike from the most dangerous direction, the front. Such a crew seating arrangement for assault helicopters has now become practically universal.

Aft of the pilots' cockpit in the Mi-24, there is a cabin for gunners with accommodations for several persons. Its specially designed doors make it possible for the gunners to exit the ship quickly after landing. Adequately strong armor has been included in the design of both cabins to protect crew members and air assault troops from small-arms fire and flak. Redundant control has been established in the helicopter to enhance its survivability in battle. If the commander occupying the rear seat is wounded, control of the helicopter is assumed by the operator-pilot sitting in the forward seat.

Mi-24 helicopters are equipped with the most modern missile and machinegun weapons. Suspended pods for four packs of free-flight missiles are arranged below the short wings. Aerial bombs can be suspended in them. Fastening attachments for guided missiles (PTUR) are arranged on the ends of the wings. In the nose part of the crew's cabin is a free swinging machinegun mount--a large caliber machinegun. Each window in the air assault troops cabin is equipped with a drawbolt mount which can be used to fire one's own weapons directly from on board the helicopter.

The world aviation press showed a great deal of interest when the prototype Mi-24 and its succeeding series models appeared in the skies. Based on conversations with their experts, especially military experts, who were invited as observers at various Warsaw Pact exercises and maneuvers, foreign journals have published and still publish quite a bit of material on this Soviet helicopter and its photographs. This heightened interest in the Mi-24 is natural, since its development in fact was a new step in world helicopter building, in particular in military helicopter building.

One of the Mi-24's special features is its speed. This helicopter was and still is to this day the fastest assault helicopter. In 1978, in one of these helicopters with the designation A-10, the official all-time world speed record for "clean"\* helicopters was established at 368.4 km/h. The helicopters achieved such high speeds thanks to excellent aerodynamic features, in particular, the use of a retractable



undercarriage.

Mikhail Leon'tovich Mil' died in 1970. His concept for a battlefield helicopter, realized only in its initial stage during his lifetime, was continued and developed by his colleagues and students headed by General Designer Marat Nikolayevich Tishchenko. Several modifications to the helicopter (see photographs) have been made based on the primary model, since the day of the prototype's first flight. Designers used in these the latest achievements of aviation science and technology to enable the helicopter to respond more completely to growing requirements of the times.

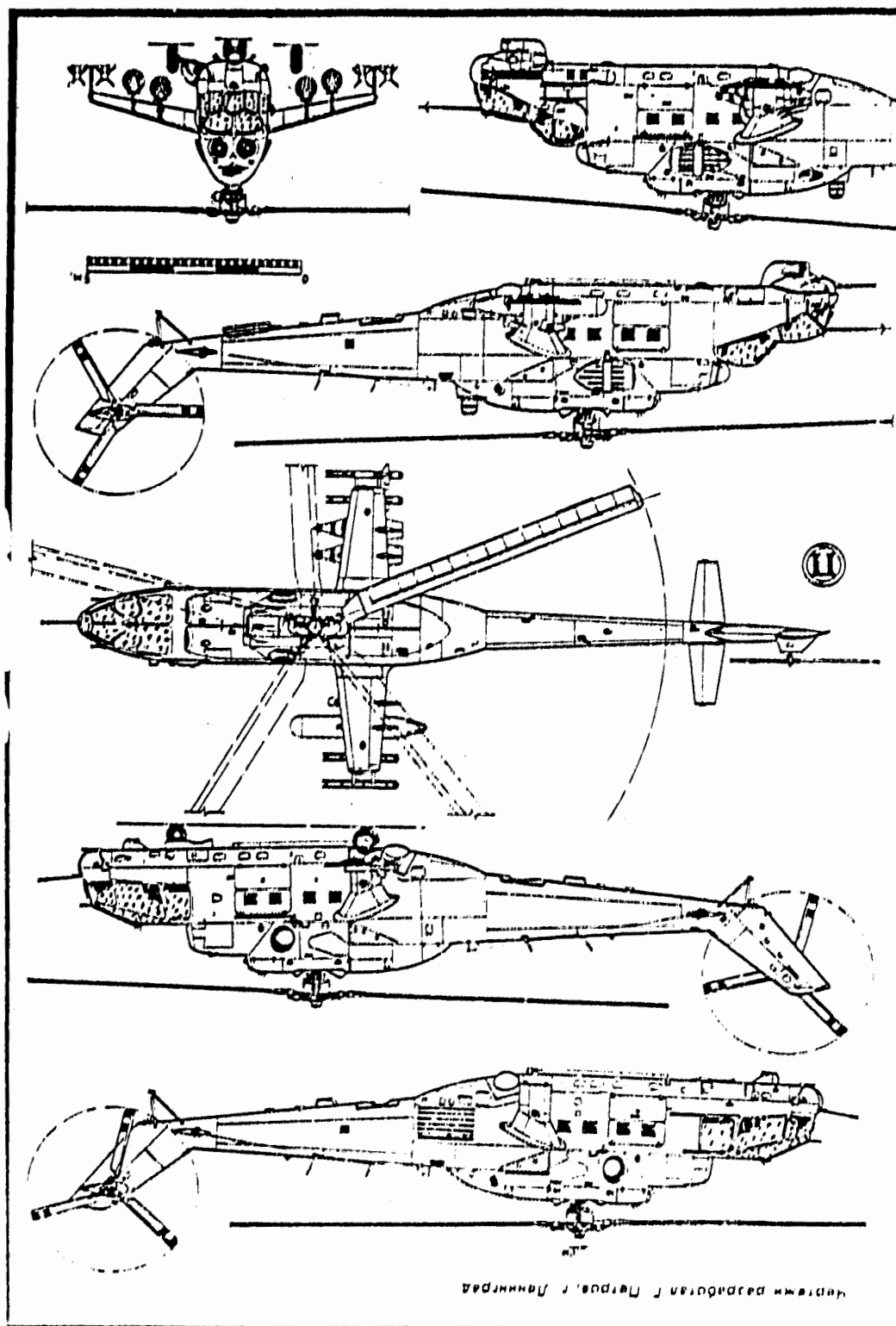
In the lower photograph is one of the Mi-24 variants with the cabin configuration considerably changed. In particular its rear section is lifted up over the forward section. This greatly improved the crew commander's visibility. Instead of the single-barrel machinegun, a four-barrel gun in a special nose turret was set up. The steering rotor was shifted from the opposite side of the fin. The sight system was changed. The engine air-intake ports were equipped with dust-protectors. To reduce IR radiation, the exhaust nozzles were covered with so-called exhaust screens. Other changes were also made to the helicopter. As a whole they considerably enhanced its combat effectiveness.

In accord with the experience of the development and daily operations of the Mi-24, practically every modification of it improved the original prototype. And although they are quite different from the first helicopter in external appearance and, most important, in combat effectiveness, the initial marking has remained. In the history of helicopter construction, the first model of the Mi-24 helicopter occupied a special place, indeed precisely the place of "forefather" of the family of specialized assault helicopters.

\*Without auxiliary engines supplying horizontal thrust (TRD [turbojet engine], air rotor-propellers and others.).

PHOTO CAPTIONS: Mi-24 before flight (facing cover); Mi-24 prototype (lower insert); Mi-24 of the first series (upper, p. 24); One of the variants of a later series (lower, p. 24)

Drawing by G. Petrov, Leningrad.



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